Ivermectin and the odds of hospitalization due to COVID-19: evidence from a quasi-experimental analysis based on a public intervention in Mexico City

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Code: https://github.com/nasaul/paper_ivermectina

Data:

https://docs.google.com/spreadsheets/d/1VtXKW1IuCm4qRowlotXnTWZlhLoQYYmEsZp7ERUIeAQ

Summary

Objective

To measure the effect of Mexico City's population-level intervention –an ivermectin-based *Medical Kit* – – in hospitalizations during the COVID-19 pandemic.

Methods

A quasi-experimental research design with a Coarsened Exact Matching method using administrative data from hospitals and phone-call monitoring. We estimated logistic-regression models with matched observations adjusting by age, sex, COVID severity, and comorbidities. For robustness checks separated the effect of the kit from phone medical monitoring; changed the comparison period; and subsetted the sample by hospitalization occupancy,

Results

We found a significant reduction in hospitalizations among patients who received the ivermectin-based medical kit; the range of the effect is 52%- 76% depending on model specification.

Conclusions

The study supports ivermectin-based interventions to assuage the effects of the COVID-19 pandemic on the health system.

1. Introduction: State of the evidence and discussion on ivermectin and COVID-19

Once COVID-19 cases are identified, early home interventions can reduce hospitalizations by treating patients in early stages. However, there is no standardized pharmacological treatment for COVID-19, nor a medical consensus about how to prevent those with mild or moderate symptoms from developing severe symptoms (Siemieniuk, R. A, 2020); mainly among patients who have not been hospitalized (Katherine J. Et Al, 2020).

Uncertainty about the best way to treat infected patients translates into difficulty in designing population-based interventions. Ivermectin is a Food and Drug Administration (FDA) approved broad spectrum antiparasitic drug used in the control of several tropical diseases (Navarro. M. et al, 2019). It was associated with COVID-19 treatment because in vitro lab studies showed that it can diminish SARS-CoV-2 viral load (See Caly, et al 2020). The proposed antiviral action on coronavirus suggests that it inhibits the binding capacity of the virus to a protein that would lead it into the nucleus. This would avoid an exaggerated immune response, leading to a normal and efficient antiviral response, suggesting that "ivermectin's nuclear transport inhibitory activity may be effective against SARS-CoV-2" (Caly, et al., 2020, 1). Some remarks against the use of ivermectin state that, in order to have effects similar to those shown in the in vitro test, doses higher than those usually administered would be necessary. Administration without medical follow up can have adverse effects in immunosuppressed people, and could cause negative interactions with other medical treatments (Chaccour, C. 2021).

On the other hand, in an ongoing meta-analysis, so far having included 18 clinical trials in 21 countries, a total of 2,282 patients have been studied. Results here show: i. a reduction in the time taken to eliminate the virus and a reduction in inflammation markers: ii. a decrease of the hospitalization time; iii. an increase of 43% in the recovery rate; iv. a 75% increase in survival rates. However, the authors consider continued clinical trials at higher scales necessary (Hill, A. et. al, 2021), as the studies have different outcome variables, the number of participants is still very small and the ivermectin doses differs among studies.

Another body of evidence consists of quasi-experimental studies in which comparisons are made retrospectively between patients who had ivermectin as part of their COVID-19 treatment and patients who didn't. In a Florida hospital, ivermectin use was associated with lower mortality rates, mainly in patients with severe pulmonary symptoms (Rajter, J. C. et al, 2021). In Bangladesh, a study indicated that among those patients who received ivermectin, lower rates of supplemental oxygen were reported (9.6% vs 45.9%), respiratory difficulties were reduced (2.6% vs 15.8%), as was the need for antibiotics (15.7% vs 60.2%), and the need for intensive care (0.09% vs 8.3%). The length of stay in hospital was nine days for the ivermectin patients vs 15 days for the control patients (Khan, M. 2020).

2.   Case study: Policy intervention in Mexico City

Facing an accelerated increase in COVID-19 cases and with critical levels of hospital saturation during December 2020, the Mexico City Government decided to expand population-based health interventions. This expansion consisted in the implementation of a prehospital home-care program that combines early detection with antigen tests, a phone-based followup for positive patients, and the provision of a medical kit containing ivermectin.

The World Health Organization (WHO) recommended the early detection of COVID-19 cases. The Mexico City Government therefore extended the testing program, from health centers and hospitals into a massive testing program in 230 temporary mobile units called "kiosks". These were opened in areas based on priority determined by COVID-19 incidence, sociodemographic characteristics, and due to ease of access[1]. The objective of the program is to reduce access barriers to identifying the infection at early stages, cut transmission chains through home isolation, and to promptly attend positive cases. Some kiosks are rotated each week based on selection criteria fluctuations, and such that access is not restricted based on place of residence. The mass testing program began on July 8th, 2020 with 3,000 tests administered daily. By mid-November, capacity was expanded to 24,000 daily tests.

The early detection of cases is complemented with a follow-up system for positive patients through Locatel (the Mexico City Government call center). Locatel contacts all patients who have tested positive for SARS-CoV-2 by telephone and by Whatsapp text message. In the call, patients who've not learned their test results are informed of the results, and referred to a doctor through another phone call where appropriate. All positive patients are asked if they are in isolation. Alarming symptoms are monitored and a follow up every two days is offered. If alarming symptoms are identified, the patient is referred to a doctor who evaluates the case through breathing exercises, and if necessary, the patient may be contacted by video-call to assess other symptoms. Serious cases are immediately transferred to 911.

Since 28 December, 2020, medical kits have been provided to positive mild to moderate symptomatic patients. The health care algorithm consists in the following process: Patients with or without respiratory symptoms[2] receive medical attention in the triage zone at the kiosks. After a clinical evaluation, an antigen test is taken. If the test is negative but the person has symptoms, they get a PCR test. When the antigen test is positive and the patient has had cough, fever, headache or covid related

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[1] Priority zones: total active cases, deaths, hospitalized patients, outpatients, positivity rate, and active cases per 100,000 inhabitants, population density, establishments with requests for disability, average number of households per dwelling, average number of persons per household, people with symptoms detected in the house-to-house program, and the proportion of the sample of follow-up patients.

[2] Cough, fever, diarrhea, polypnea, arterial pain or abdominal pain, dyspnea, chest pain or cyanosis.

symptoms within the past 10 days, they are referred to a doctor for a prescription, a medical kit, and guidance on prevention, as well as instructions on handling any alarming symptoms. If alarming symptoms are presented, among them, dyspnea, chest pain or cyanosis, the patient is referred to a hospital. The medical kit contains ivermectin (four six mg. tablets, two pills for two days), paracetamol (ten 500 mg tablets, one tablet every eight hours, if symptoms are present) and acetylsalicylic acid (30 100 mg tablets, one pill daily for 14 days)[3]. After one month and the delivery of 83,000 medical kits, detailed data was collected on the evolution of patient illnesses including among those whose symptoms required hospital admission.

The present study consists of a quasi-experimental evaluation of the effects of the medical kits on hospitalization for COVID-19 in Mexico City based on all of this and a matching methodology to identify the effect of ivermectin on the odds of hospitalization. Additionally, we ran a series of robustness checks to verify that the effect found holds with multiple sets of population groups and is not driven by other causes, such as patient monitoring.

3.   Methodology
a.   Research design

To assess the effect of ivermectin on hospitalizations in Mexico City, we used a quasi-experimental research design. We make use of statistical methods that match cases based on observable co-variants, reducing the possible imbalance on those variables, and allowing us to estimate systematic differences in the dependent variable (i.e. hospitalization); between those who received the medical kit and those who did not. This method recreates the randomization of treatment by statistically making those treated and untreated indistinguishable on all relevant co-variants except the existence of the treatment (i.e.; got the medical kit with ivermectin or did not). We used the Coarsened Exact Matching method to match observations. This method belongs to the class of Monotonic Imbalance Bounding methods, in which balance between the control and treatment groups is chosen by the user and not by the continuous re-estimation process (Blackwell, M., 2009).

b.   Data sources and analytical sample

The sample used for this study was built through the merger of three data sources. First, all of the records of positive tests for COVID-19 registered in the SISVER system (Epidemiological Surveillance of Respiratory Diseases System), from 23 November, 2020 to 28 January, 2021. We selected individuals who were positive outpatients, both from tests performed at the kiosks and from Family Medical Units

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[3] The kit contained azithromycin, but this treatment was discontinued on January 25, 2020.

(FMU). From this database we used comorbidities, symptoms, and some sociodemographic variables. Second, a database which integrates hospitalization data collected in Mexico City by public hospitals (such as SEDESA, IMSS, ISSSTE, CCINSHAE, and SEMAR[4]), from 24 November, 2020 to 8 February, 2021. Third, the Locatel telephone follow-up system, which takes advantage of the SISVER records to contact positive cases. The three data sources are merged using the *Unique Population Registry Code* (CURP), a national identifier unique to each Mexican citizen and legal residents. This allowed for the matching by this ID variable to the records of the three databases.

From these sources, we generated two databases for the analytical sample based on how the treatment variable was built. The first option was built by an *administrative rule* under which we assumed that all cases with a positive antigen test and symptoms received the medical kit after the program began (treatment). The control group came from people who were tested between 28 November and the beginning of the program on 28 December, and of course, who did not receive the kit (control). The second data source was built by assigning the treatment to people identified by Locatel in their follow up as having received the kit vs those reported as not receiving the kit, and then observing whether or not they were later admitted to a hospital.

We analyzed a total of 156,468 patients with COVID-19 infection before implementing the ivermectin program (controls), and 77,381 after the implementation. Similarly, from the telephonic follow-up, 57,598 did not receive the kit (controls) and 18,074 received the kit (treated).
The data and variables were coded as follows:

c. **Measures**

Dependent/outcome variable: Hospitalized, dichotomous variable that identifies whether or not the person was hospitalized.

Independent/Treatment Variable: I. **Medical Kit**: Dichotomous variable of each person who received the medical kit including ivermectin is assigned a 1 and those who do not receive it a 0. II. **Locatel follow-up**: A dichotomous variable in which 1 was assigned to people who agreed to receive telephone and medical follow-up via Locatel.

Covariates

1. **Sex:** Dichotomous variable (1 is male and 0 is female).
2. **Serious comorbidities**: Additive scale in which 1 is added for each comorbidities reported by the patient (1 - 6): diabetes, obesity, immunosuppression, COPD, heart disease, or kidney failure.

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[4] The Mexico City Health Minister (SEDESA); Mexican Social Security Institute (IMSS); Institute for Social Security and Services for State Workers (ISSSTE); Coordinating Commission of National Health Institutes and Hospitals of High Specialization (CCINSHAE); Marine Ministry (SEMAR).

3. **Serious symptoms**: Additive scale in which 1 is added for each of the following symptoms (1-3): dyspnea, chest pain or cyanosis

4. **Moderate symptoms**: Additive scale in which 1 is added for each of the following symptoms (1-7): cough, fever, diarrhea, polypnea, arterial pain, or abdominal pain.

5. **Age groups**: These following are 5 dichotomous variables in which 1 is assigned if the patient is in any of the following age groups and 0 if it is in any other age range (<30, 31-40, 41-50, 51-60, 61-70, >70).

Variable	With kit: N	With kit: %	Without kit: N	Without kit: %
Hospitalized	311	0.4%	1,884	1.21%
Locatel followup	58,045	75.06%	73,467	47.09%
Male	36,167	46.77%	74,394	47.69%
0-30 years	24,778	32.04%	48,511	31.09%
31-40 years	16,248	21.01%	33,794	21.66%
41-50 years	15,612	20.19%	31,650	20.29%
51-60 years	11,931	15.43%	24,351	15.61%
61-70 years	5,926	7.66%	11,860	7.6%
70+ years	2,832	3.66%	5,845	3.75%

Variable	With kit: Mean	With kit: Sd	Without kit: Mean	Without kit: Sd
Severe comorbidities	0.19	0.44	0.20	0.45
Severe symptoms	0.32	0.58	0.30	0.58
Moderate symptoms	1.40	1.13	1.39	1.28

Table 1: Mean, standard deviation and proportion of variables by treatment and control group.

d. Identification Strategy

After balancing the observations over the covariates with CEM, we run a robust binomial logistic regression to estimate the probability of being hospitalized, conditional on controls, and on delivery of the medical kit. This guarantees that cases are identical in all factors but the presence or absence of the treatment.

Given the data sources and distribution, there are some legitimate criticisms to be made on the potential confounding: 1. We can't separate time periods from treatment in the administrative data; 2. Along with the medical kit, patients are also subject to telephone medical monitoring, so we need to disentangle the effect of medication from attention; 3. Related to the first point, in the later period when the kit program began, the percentage of occupied beds was visibly higher, thus, we need to show that the effect of the medical kit with ivermectin holds at similar levels of hospitalizations. We perform some

robustness checks and sub-sampling specifications to confirm that the effect of the ivermectin-based kit on the probability of hospitalization holds regardless of time, hospital saturation, and medical follow-up.

Model 1: General model, with *administrative rule*

We used administrative data from Hospitals and SISVER and assigned treatment to all patients who met the criteria for receiving the medical kit after the beginning of the program on 28 December and continuing through 28 January. The control group are positive symptomatic patients, from 23 November to 28 December, and the treated group are positive symptomatic patients from 28 December to 28 January. The match was made with the following variables: comorbidities, male, severe symptoms, moderate symptoms, and age ranges: older than 70 years, between 61 - 70 years, 51 - 60 years , 41 - 50 years, and 31 - 40 years.

Robustness Checks

We performed a robustness test to assess if the effect of the medical kit on hospitalization was not due the following biases or confounding:

1. We isolated the effect of the medical kit from the Locatel follow-up. For that we tested the general model (model 1) in sub-samples: i. Effect of the medical kit on hospitalization, sub-sample without Locatel follow-up (Model 2); ii. Effect of the medical kit on hospitalization, sub-sample with Locatel follow-up (Model 3); iii. Effect of locatel follow-up on hospitalization, sub-sample of people who received a medical kit (Model 4); iv. Effect of Locatel follow-up on hospitalization, sub-sample of people who did not receive a medical kit (Model 5).

2. We controlled for hospitalization occupancy in a shorter period of time, with a subsample where hospital occupancy was between 80% y 85%, to confirm that the effect found in the general model is not due to a lower probability of finding a hospital in the treated group. The treated group are positive symptomatic patients between 28 December and 28 January and the control group are positive symptomatic patients between 15 and 28 December (Model 6).

3. To control for possible confounders we used a different database to determine the treatment group and control group. With the administrative records of Locatel follow-up treatment, all persons who confirmed they'd received the medical kit were assigned to the treatment group, and to the control group, those who confirmed they hadn't received it.

4. Finally, we stratified the effect of the control variables with decision trees to estimate the heterogeneity in the causal effects to observe differences in the treatment effects between sub-samples of the population (Athey, S., & Imbens, G. , 2016).

5. Results

In all the specifications, we found a negative and significant effect of the ivermectin-based medical kit on the probability of hospitalization among the patients who received it vis-a-vis those who did not. Depending on the subsampling, the effect ranges from 50% to 76% difference in hospitalization odds between treated and untreated patients, statistically significant in all cases.

Model 1:

As shown in Figure 1, the use of the ivermectin kit was associated with a 68.4% (0.316***) lower probability of being hospitalized after matching the observations over covariates (see Appendix 1 for full details on the balancing and results). As expected, the covariant show positive and significant effects on the odds of hospitalization.
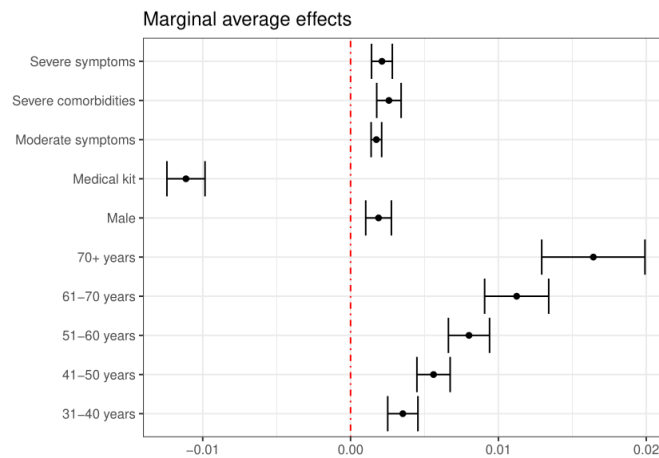

Figure 1: Marginal effects of ivermectin on hospitalization with administrative rule database.

Models 2 to 5: Disentangling the effect of the ivermectin-based kit from medical follow-up

The intervention consisted in providing the ivermectin kit, but also in offering a patients follow up implemented by the Locatel call center. To isolate the effect of the ivermectin kit from the Locatel tracking.

As shown in figure 2, the effect of the medical kit on hospitalization was negative in both, with and without, Locatel tracking subsets. Where a person has 76% (0.234***) lower probability of being hospitalized when receiving the medical kit in the Locatel tracking subset, and 50% (0.5***) in the subset without Locatel tracking. Additionally, in the subset of people who received the kit, the effect of Locatel tracking shows that there is 29.5% (0.705***) less probability of being hospitalized. In opposition, the

subset without the medical kit, the relationship between Locatel tracking and hospitalizations turned out to be positive (43.9%, (1.439***)). (see appendix 1)
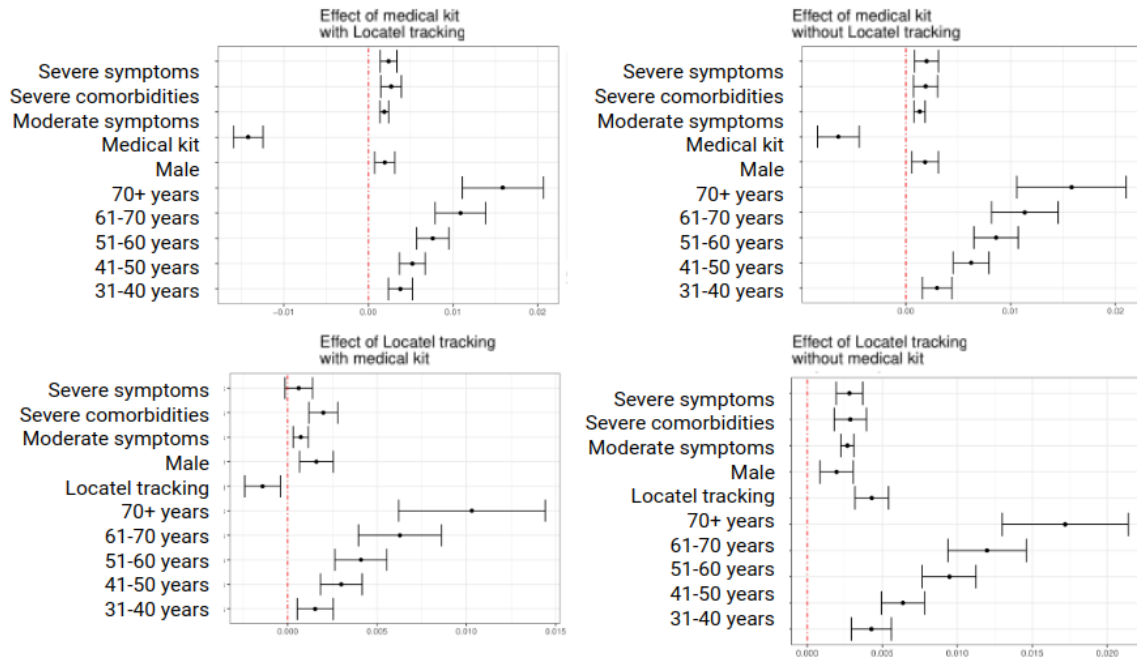

Figure 2: Marginal effects of ivermectin on hospitalization with administrative rule database. Subsets- with & without the medical kit and Locatel tracking (Models 1-5).

Model 6: Disentangling the effect of the medical kit from hospital occupancy

When controlling for hospital occupancy (between 80-85%) the use of the medical kit was associated with a 68.6% (0.314***) lower probability of being hospitalized. As expected, at this level of hospital occupancy, all variables lose explanatory value.
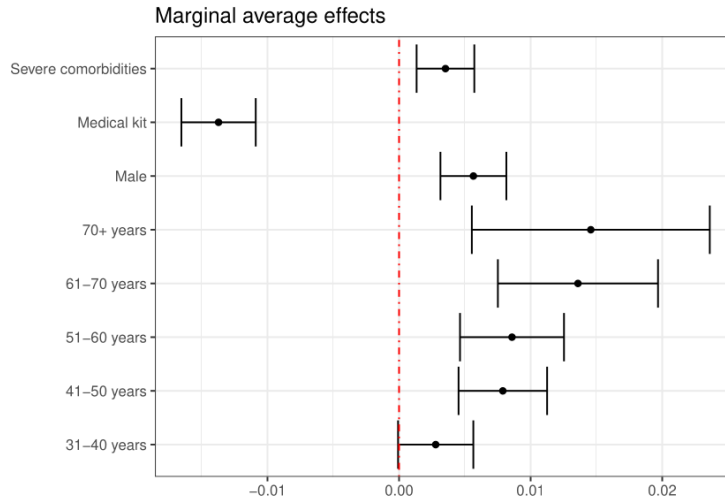
Figure 3: Marginal effects of ivermectin on hospitalization with administrative rule database. Subsets at between 80 y 85% of hospital occupancy (6).

Model 7: Disentangling the effect of the medical kit from time periods

In order to compare treated and untreated populations during the same periods of time, we use the data from self-reported access to the kit. The results for the Locatel follow up treatment assignment option show a similar trend. The use of the medical kit was associated with a 74.4% (0.256***) lower probability of being hospitalized between 28 December 2020 and 28 January 2021. This was very similar to the effect found in model 1, under the administrative rule.
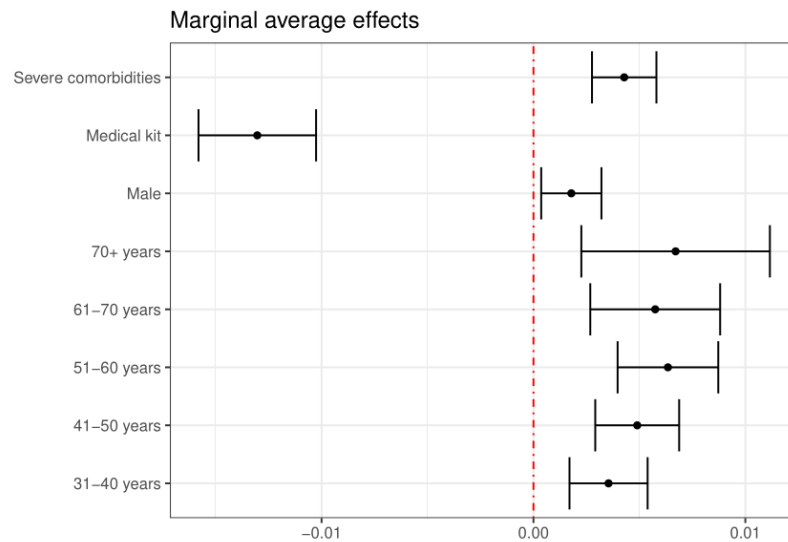

Figure 4: Marginal effects of ivermectin on hospitalization with Locatel follow up database.

Subpopulation effects:

Using the administrative data from the hospitals, we can evaluate the effect of the treatment to various populations according to the risk of worsening symptoms. As expected, the effect of the medical kits is higher and stronger among males, in older patients, and in cases without severe symptoms (See appendix 1 for details of the analysis).

5. Discussion and limitations

This research adds to the discussion by testing the hypothesis in a quasi-experimental evaluation that ivermectin has a negative relation to the odds of being hospitalized. The results add up to the body of research previously discussed.

In a large non-randomized intervention trial, we observed a reduction in the risk (from 55 to 70%) of hospitalization in those receiving a kit including Ivermectin, compared with those not receiving it. Lacking randomization, is expected that the comparison groups have differences in measured variables but also in unmeasured variables. In fact, treated and untreated groups we found that the medical kit given en masse to patients who'd tested positive in Mexico City had a negative, significant, and robust effect on their odds of being hospitalized. Specifically, we showed that the effect holds independently of the medical telephone follow up by Locatel, the level of hospital occupancy, and the specific period of time.

Adjusting by available variables including some of the most powerful predictors of adverse outcomes such as age, gender and comorbidities, or matching by propensity scores based on the same variables, the beneficial effect of receiving the kit with ivermectin is sustained. A variety of other contributors to the risk of hospitalization could be mentioned and only some of them studied. For example in the weeks of highest incidence of disease, hospital occupation was very high wih poor availability of beds, and this could explain the lack of hospitalization in some patients requiring it. When this was taken into account, the benefit of the kit treatment was still observed.

Although in the literature there are not many examples of population studies, our results show a similar trend as the only other population case study, that found a reduction in mortality rates in Perú (Chamie-Quintero Et Al, 2021). Also, in this study we are not testing for the causal mechanisms of the relation between the ivermectin and the reduction in probability of being hospitalized, however, many studies show that one of the principal mechanisms is the reduction of te viral load, in the patients that take ivermectin in early stages of the disease, which leads to lower levels of inflammatory reaction and therefore reduces the need of being hospitalized (Hill, A. et. al, 2021, Khan, M. 2020).

There are some limitations to this analysis. First, as in any observational study, there is no random assignment of the treatment on the treated, which limits the identification strategy, specifically considering unobservable covariants, since the matching method only considers observable covariants.

Second, our dependent variable is a dummy as to whether a patient was or was not eventually hospitalized. The main problem is that being hospitalized is not an objective observation removed from individual medical assessments. That is, patients with similar symptoms might or might not be admitted to a hospital based purely on the individual judgment of a medical professional. However, we do not find any reason to relate this judgement to the receipt or non-receipt of the medical kit. Third, it may be said that using the odds of death is a more objective measure, however in the period between a positive diagnosis and death, there is also a sequence of subjective decisions made by the patient and medical personnel. An extension of this analysis to identify the effect of the medical kit on the odds of dying from COVID-19, in a hospital or at home, should be performed in the future. Finally, it may be argued that the treated population has a self-selection bias given that they voluntarily choose to go to a kiosk to find out their status and to ask for a medical assessment. These are patients already concerned with their status and health, and this reduces their risk of worsening symptoms and hospitalization. We agree with this argument, however, both treated and untreated groups attended a kiosk seeking the same answers, and then showed similar levels of self-care.

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Appendix 1: Analysis

Sample Size

	Control	Treated
All (ESS)	156,468	77,381
All	156,468	77,381
Matched (ESS)	136,674	77,327
Matched	156,011	77,327
Unmatched	457	54
Discarded	0	0

Table 1: Analytic sample size, by administrative rule

	Control	Treated
All (ESS)	57,598	18,074
All	57,598	18,074
Matched (ESS)	56,956	18,074
Matched	57,581	18,074
Unmatched	17	0
Discarded	0	0

Table 2: Analytic sample size, by Locatel follow-up

	Control	Treated
All (ESS)	73,644	58,082
All	73,644	58,082
Matched (ESS)	61,470	57,983
Matched	73,374	57,983
Unmatched	270	99
Discarded	0	0

Table 3. Sub-set, with Locatel follow up

	Control	Treated
All (ESS)	82,824	19,299
All	82,824	19,299
Matched (ESS)	72,017	19,260
Matched	81,921	19,260
Unmatched	903	39
Discarded	0	0

Table 4: Sub-set, without Locatel follow up

	Control	Treated
All (ESS)	19,299	58,082
All	19,299	58,082
Matched (ESS)	18,150	57,671
Matched	19,218	57,671
Unmatched	81	411
Discarded	0	0

Table 5: Sub-set, with medical kit

	Control	Treated
All (ESS)	82,824	73,644
All	82,824	73,644
Matched (ESS)	77,843	73,516
Matched	82,549	73,516
Unmatched	275	128
Discarded	0	0

Table 6: Sub-set, without medical Kit

	Control	Treated
All (ESS)	12,060	19,772
All	12,060	19,772
Matched (ESS)	11,963	19,762
Matched	12,055	19,762
Unmatched	5	10
Discarded	0	0

Table 7: Sample size, administrative rule database, hospital occupancy subset

Descriptive statistics

Variable	With kit: N	With kit: %	Without kit: N	Without kit: %
Hospitalized	311	0.4%	1,884	1.21%
Locatel followup	58,045	75.06%	73,467	47.09%
Male	36,167	46.77%	74,394	47.69%
0-30 years	24,778	32.04%	48,511	31.09%
31-40 years	16,248	21.01%	33,794	21.66%
41-50 years	15,612	20.19%	31,650	20.29%
51-60 years	11,931	15.43%	24,351	15.61%
61-70 years	5,926	7.66%	11,860	7.6%
70+ years	2,832	3.66%	5,845	3.75%

Variable	With kit: Mean	With kit: Sd	Without kit: Mean	Without kit: Sd
Severe comorbidities	0.19	0.44	0.20	0.45
Severe symptoms	0.32	0.58	0.30	0.58
Moderate symptoms	1.40	1.13	1.39	1.28

Table 8: Mean, standard deviation and proportion of variables by treatment and control group.

Models summary tables:

Model	Data	Period	Matched by	Effect of Kit on hospitalization	P-value
Model 1 General model - administrative rule	SISVER, Hospitals	Control group: 23 Nov - 28 Dec Treated group: 28 Dec - 28 Jan	Comorbidities, male, severe symptoms, moderate symptoms and age ranges older than 70 years, between 61-70 years, 51 - 60 years, 41- 50 years, and 31 - 40 years.	• 68.4%	0.000
Model 2 General model- subsample: Locatel follow up, effect of medical kit	SISVER, Hospitals	Control group: 23 Nov- 28 Dec Treated group: 28 Dec-28 Jan	Comorbidities, male, severe symptoms, moderate symptoms and age ranges older than 70 years, between 61-70 years, 51 - 60 years, 41- 50 years, and 31 - 40 years	• 76%	0.000

Model 3 general model - subsample: without Locatel followup, effect of medical kit	SISVER, Hospitales	Control group: 23 Nov- 28 Dec Treated group: 28 Dec - 28 Jan	Comorbidities, male, severe symptoms, moderate symptoms and age ranges older than 70 years, between 61-70 years, 51 - 60 years, 41- 50 years, and 31 - 40 years	• 50%	0.000
Model 4 general model - subsample: received medical kit, effect of follow up	SISVER, Hospitales	Control group.: 23 Nov - 28 Dec Treated group: 28 Dec - 28 Jan	Comorbidities, male, severe symptoms, moderate symptoms and age ranges older than 70 years, between 61-70 years, 51 - 60 years, 41- 50 years, and 31 - 40 years	• 29.5%	0.005
Model 5 general model - subsample: didn't receive medical kit, effect of follow up	SISVER, Hospitales	Control group: 23 Nov - 28 Dec Treated group: 28 Dec - 28 Jan	Comorbidities, male, severe symptoms, moderate symptoms and age ranges older than 70 years, between 61-70 years, 51 - 60 years, 41- 50 years, and 31 - 40 years	• 43.9%	0.000
Modelo 6 general model - subsample: 80-85% of hospital occupancy	SISVER, Hospitales	Control group: 15 - 28 Dec. Treated group: 28 Dec - 28 Jan	Comorbidities, male, severe symptoms, moderate symptoms and age ranges older than 70 years, between 61-70 years, 51 - 60 years, 41- 50 years, and 31 - 40 years	• 68.6%	0.000
Model 7 Locatel model	SISVER, Hospitales Locatel	Control group: 28 Dec - 28 Jan Treated group: 28 Dec - 28 Jan.	Comorbidities, male, age ranges older than 70 years, between 61-70 years, 51 - 60 years, 41- 50 years, and 31 - 40 years	• 74.4%	0.000

Table 09: Model´s summary tables

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
(Intercept)	0.004***	0.005***	0.003***	0.001***	0.003***	0.009***	0.006***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Medical kit	0.316***	0.234***	0.500***			0.314***	0.256***
	(0.000)	(0.000)	(0.000)			(0.000)	(0.000)
Male	1.216***	1.220***	1.219***	1.492***	1.180***	1.611***	1.206**
	(0.000)	(0.000)	(0.002)	(0.001)	(0.000)	(0.000)	(0.011)
Severe comorbidities	1.308***	1.318***	1.226***	1.643***	1.274***	1.347***	1.565***
	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.003)	(0.000)
Severe symptoms	1.245***	1.278***	1.238***	1.167	1.268***		
	(0.000)	(0.000)	(0.000)	(0.115)	(0.000)		
Moderate symptoms	1.198***	1.214***	1.153***	1.199***	1.254***		
	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)		
31-40 years	1.702***	1.712***	1.647***	2.024***	1.651***	1.401*	1.577***
	(0.000)	(0.000)	(0.000)	(0.002)	(0.000)	(0.051)	(0.000)
41-50 years	2.117***	1.981***	2.361***	2.999***	1.974***	2.143***	1.798***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
51-60 years	2.600***	2.440***	2.885***	3.735***	2.452***	2.245***	2.036***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
61-70 years	3.255***	3.072***	3.492***	5.202***	2.842***	2.987***	1.938***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
70+ years	4.320***	4.043***	4.490***	7.933***	3.660***	3.133***	2.096***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Locatel tracking				0.705***	1.439***		
				(0.005)	(0.000)		
Num.Obs.	233338	131357	101181	76889	156065	31817	75655
AIC	25859.1	14442.0	10913.5	3827.6	19618.8	3956.5	8011.6
BIC	25973.1	14549.6	11018.2	3929.4	19728.3	4031.8	8094.7
Log.Lik.	-12918.561	-7210.001	-5445.731	-1902.812	-9798.377	-1969.259	-3996.809

* p < 0.1, ** p < 0.05, *** p < 0.01

Table 10: Model's summary table
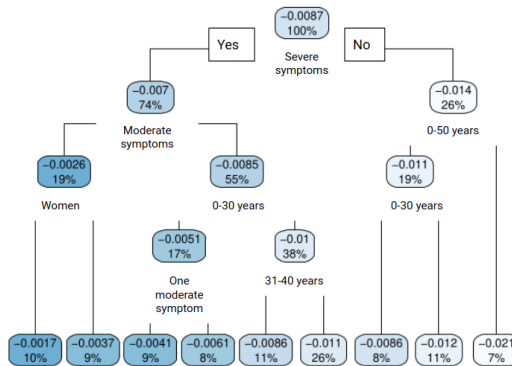
Stratification tree analysis:

Figure 5: Stratified effect of control variables, administrative rule sample.